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Smart Cards; UICC - Contactless Front-end (CLF) Interface; Host Controller Interface (HCI) (Release 14)

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1 Scope

The present document specifies a logical interface that enables contactless applications hosted on the UICC. The present document covers the configuration where the one host is embedded in the UICC which is connected to the host controller embedded in the CLF.

The interface is specified in two parts:

- the HCI core as described in the first part of the present document (clauses 4 to 8), specifies an application independent logical interface; and
- the contactless platform as described in the second part of the present document (clauses 9 to 11) specifies an implementation of the HCI core for contactless applications using the UICC and the CLF.

Lower layer protocols that support the HCI like the SWP specified in ETSI TS 102 613 [2] are out of the scope of the present document.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] Void.
- [2] ETSI TS 102 613: "Smart Cards; UICC - Contactless Front-end (CLF) Interface; Part 1: Physical and data link layer characteristics".
- [3] ETSI TS 102 223: "Smart Cards; Card Application Toolkit (CAT)".
- [4] ISO/IEC 18092: "Information technology - Telecommunications and information exchange between systems - Near Field Communication - Interface and Protocol (NFCIP-1)".
- [5] ISO/IEC 14443-2: "Identification cards - Contactless integrated circuit(s) cards - Proximity cards - Part 2: Radio frequency power and signal interface".
- [6] ISO/IEC 14443-3: "Identification cards - Contactless integrated circuit(s) cards - Proximity cards - Part 3: Initialization and anticollision".
- [7] ISO/IEC 14443-4: "Identification cards - Contactless integrated circuit cards - Proximity cards - Part 4: Transmission protocol".
- [8] ISO/IEC 7816-4: "Identification cards - Integrated circuit cards - Part 4: Organization, security and commands for interchange".
- [9] ETSI TS 101 220: "Smart Cards; ETSI numbering system for telecommunication application providers".

- [10] ISO/IEC 7816-3: "Identification cards - Integrated circuit cards - Part 3: Cards with contacts - Electrical interface and transmission protocols".
- [11] ETSI TS 102 221: "Smart Cards; UICC-Terminal interface; Physical and logical characteristics".
- [12] GlobalPlatform: "Multiple Contactless Card Emulation Environ Managing Entity V1.0 GPC_SPE_114".
- NOTE: Available at <https://globalplatform.org/specs-library/multiple-contactless-card-emulation-environments-managing-entity-v1/>.
- [13] NFC Forum: "NFC Controller Interface (NCI) Technical Specification 2.1".

2.2 Informative references

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] JIS X 6319-4:2005: "Specification of implementation for integrated circuit(s) cards -- Part 4: High speed proximity cards".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

embedded secure element host: host implemented in a non-removable secure element

gate: entry point towards a service that is operated inside a host

host: logical entity that operates one or more service(s)

host controller: host that is also responsible for managing a host network

host network: network of two or more hosts

Managing Host (MH): host which is in charge of resolving conflicts and interoperability issues between different contactless applications provided by different hosts as defined in GlobalPlatform Card; Multiple Contactless Secure Elements - Managing Entity [12]

pipe: logical communication channel between two gates from different hosts

registry: data related to a gate that are stored as a collection of parameter - value pairs

service: collection of related atomic functions in a host for management purposes or for performing contactless actions

3.2 Symbols

For the purpose of the present document the following symbols apply:

| | |
|-----------------|-----------------|
| G _{ID} | gate identifier |
| H _{ID} | host identifier |

| | |
|----------|---|
| P_{ID} | pipe identifier |
| $PIPE_x$ | a pipe with a P_{ID} value equal to x |

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

| | |
|---------|---|
| AFI | Application Family Identifier |
| AID | Application IDentifier |
| APDU | Application Protocol Data Unit |
| ATR | Answer To Reset |
| BER-TLV | Basic Encoding Rules - Tag, Length, Value |
| C-APDU | Command APDU |
| CB | Chaining Bit |
| CLF | ContactLess Front-end |
| CLT | ContactLess Tunnelling |
| CRC | Cyclic Redundancy Code |
| HCI | Host Controller Interface |
| HCP | Host Controller Protocol |
| JIS | Japanese Industrial Standard |
| LEN | LENGth |
| MH | Managing Host |
| NCI | NFC Controller Interface |
| NFC | Near Field Communication |
| NFCEE | Near Field Communications Execution Environment |
| PA | PreAmble |
| PCD | Proximity Coupling Device |
| PICC | Proximity Card |
| R-APDU | Response APDU |
| REF | REFeRence data |
| RF | Radio Frequency |
| RFIN | RF data INcoming |
| RFU | Reserved for Future Use |
| RO | Read-Only |
| RST | ReSeT |
| RW | Read/Write |
| SAK | Select AcKnowledge |
| SD | Secure Digital |
| SWP | Single Wire Protocol |
| UI | User Interface |
| WO | Write-Only |

3.4 Void

The content of this clause has been moved to clause 3A.

3A Coding conventions

For the purposes of the present document, the following coding conventions apply:

- All lengths are presented in bytes, unless otherwise stated. Each byte is represented by bits b8 to b1, where b8 is the most significant bit and b1 is the least significant bit. In each representation, the leftmost bit is the most significant bit.
- Hexadecimal values are specified between single quotes, e.g. '1F'. In a sequence of bytes, byte 1 is the leftmost byte.
- All bytes specified as RFU shall be set to '00' and all bits specified as RFU shall be set to 0.

4 HCI architecture

4.1 Overview

A valid host network has a star topology where one or more hosts physically connect to a host controller. The HCI defines the interface between hosts. More specifically the HCI has three levels:

- a collection of gates that exchange commands, responses and events; and
- an HCP messaging mechanism; and
- an HCP routing mechanism that may optionally segment messages when required.

Figure 1 illustrates the HCP stack in a possible host network.

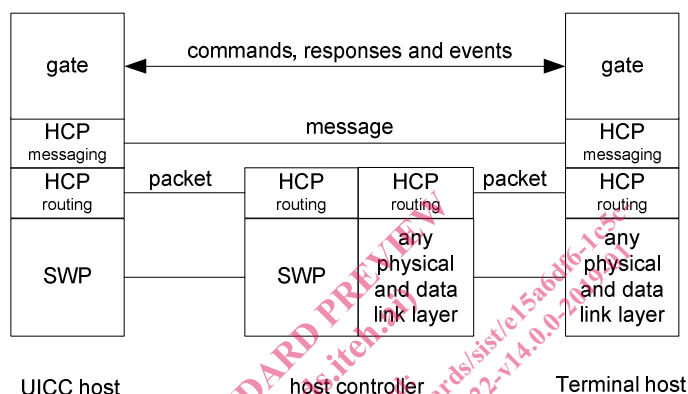


Figure 1

NOTE: For clarity only two gates are shown. In particular the host controller also has gates that connect via HCP to other hosts.

For proper operation, the HCP requires underlying data link layers to have the following properties:

- The data link layer (e.g. SWP) shall be error free and the order of the received/sent data shall be respected.
- The data link layer provides its own data flow control.
- The data link layer shall deliver packets of the upper layer up to a maximum size specific to the data link layer.
- The data link layer shall report the size of each received packet to its upper layer.
- If the data link layer is defined in ETSI TS 102 613 [2]:
 - If available, additional information as power mode and contactless transaction pending shall be reported by the data link layer.
 - The data link layer shall be able to exchange identity reference data.

4.2 Hosts

The identity of a host is coded in a byte. Table 1 lists the reserved values for the host identifier, H_{ID} .

Table 1

| Host | H _{ID} |
|-----------------------|---|
| host controller | '00' |
| terminal host | '01' |
| UICC host | '02' |
| RFU | '03' to '7F' |
| Dynamically allocated | '80' to 'BF' |
| Proprietary | 'C0' to 'FF' |
| NOTE: | If more than one UICC host is supported, see details below. |

In the present document, the generic term "host" is used to refer to any logical host (e.g. terminal host, UICC host) excluding the host controller.

The dynamically allocated range of values shall be used by the host controller to assign a host identifier to any host not identified in table 1. The host controller shall always assign the same H_{ID} to a given host throughout different sessions as long as there is no modification in the hardware configuration of the device. When the host controller uses a dynamically allocated H_{ID} for a host, the host will be able to retrieve its own H_{ID} upon pipe creation (Source H_{ID} in the answer to ADM_CREATE_PIPE command) or in the host controller administration gate registry.

If more than one UICC host is supported, the H_{ID} value '02' applies to pre-release 12 UICCs. Other UICCs if present will use dynamically allocated H_{ID} values. In the case of several pre-release 12 UICCs, the host controller should avoid having these UICCs active at the same time as they present the same H_{ID}.

NOTE: The Host controller can detect a UICC supporting release 12 or later by the fact that the UICC sets the HOST_TYPE in the Host Controller administration gate.

4.3 Gates

A gate provides an entry point to a service that is operated inside a host. The HCP enables gates from different hosts to exchange messages. There are two types of gates:

- Management gates that are needed for the management of the host network.
- Generic gates that are not related to the management of the host networks. Only the generic aspects of these gates are defined in the HCI core.

The type of a gate is identified by a gate identifier. Gate identifiers are listed in table 2 and are either unique within the scope of a host ('10' to 'FF'), or their values refer to the same gate type for every host ('00' to '0F').

Table 2

| Gate | G _{ID} |
|------------------------------|-----------------|
| reserved for proprietary use | '00' to '03' |
| loop back gate | '04' |
| identity management gate | '05' |
| RFU | '06' to '0F' |
| Host specific | '10' to 'EF' |
| reserved for proprietary use | 'F0' to 'FF' |

Host specific gates for hosts defined in the present document (including RFU ones) are reserved for use in the present document.

The following rules apply to hosts and gates:

- all hosts and the host controller shall have one administration gate (see clause 7.1.1);
- all hosts may have one link management gate (see clause 7.1.2) and the host controller shall have one link management gate;

- all hosts and the host controller shall have one identity management gate (see clause 7.1.3);
- all hosts and the host controller shall have one loop back gate (see clause 7.1.4); and
- all hosts and the host controller may have one or more generic gates (see clause 7.2).

4.4 Pipes

A pipe is a logical communication channel between two gates. There are two types of pipes:

- static pipes that are always available, i.e. they do not need to be created and cannot be deleted; and
- dynamic pipes that can be created and deleted.

The state of a pipe is either open or closed. The state shall remain persistent if the hosts are powered down and up again. It shall also remain persistent if a host is temporarily removed from the host network and was not replaced by a different device in the meantime. The state of a dynamic pipe after creation and the initial state of a static pipe shall be closed.

The pipe identifier, P_{ID} , is 7 bits long. The value of P_{ID} is used in the header of HCP packets as routing information (see clause 5.1). For static pipes the pipe identifiers are predefined with values as defined in table 3. For dynamic pipes, pipe identifiers are dynamically allocated by the host controller.

Table 3

| P_{ID} | Pipe ending at: | Pipe type |
|--------------|----------------------|-----------|
| '00' | link management gate | static |
| '01' | administration gate | |
| '02' to '6F' | other gates | dynamic |
| '70' to '7F' | RFU | |

The following rules apply to gates and pipes:

- a static pipe always connects a gate of a host to a gate of the host controller;
- a dynamic pipe connects two gates from different hosts;
- static and dynamic pipes connect to different types of gates; see table 3 for the mapping; and
- dynamic pipe identifiers shall be unique in the host network.